

Ch 8

Chemical Eqns

①

↳ represent reactants + products in chemical rxns

All agree w/ LCM

use coefficients to represent molecules



2 types of eqns

formula equations - represent reactants + products w/ formula

word eqns - sent explains what happens in rxn

needed symbols

solid or ppt $\rightarrow \downarrow$ or (s) \rightarrow yields

gas $\rightarrow \uparrow$ or (g) $\xrightarrow{\text{MnO}_2}$ MnO₂ catalyst

liquid $\rightarrow \ell$ \rightleftharpoons reversible

in H₂O aqueous \rightarrow aq

Δ heat

Eqns tell us 1. Amounts reactants + products + Ratios



1 mol 1 mol 2 mol

Ch 8 HMWK pg 244 2, 5; pg 251 2, 3, 4; pg 255 2, 3

pg 257 Problems 3, 7, 8, 9, 10

pg 259 AP Problems #16

c1

H HWK

pg 257 Prob 4, 8

258 Prob 19, 20

Balancing Equations

②

Rules 1. Make all diatomics, diatomic if necessary
 $O \rightarrow O_2$ etc

2. Balancing everything but H + O

3. Balance H

4. Balance O

Note: Polyatomic ions if on both sides can be treated as 1 unit.

5. Check to make sure it is Balanced

8.2 Types of Chemical Rxns

③

↳ Millions of different chemical rxns possible
impossible to ~~predict~~ learn them all

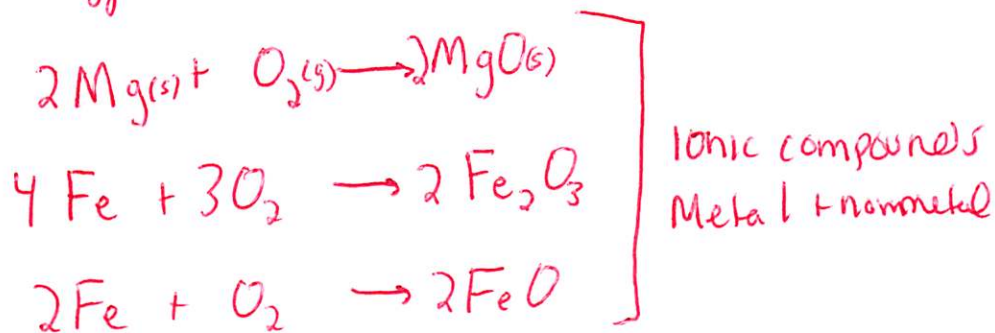
But given reactants we can ~~learn~~ predict products
we just need to know types of chemical reactions
Basis for organic rxns. Learn a bunch of rxns can do anything

Synthesis Rxns

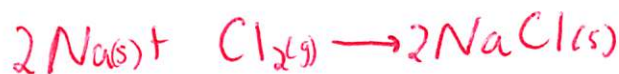
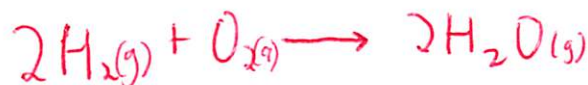
↳ two or more substances combine to form new products

represented by $A + X \rightarrow AX$

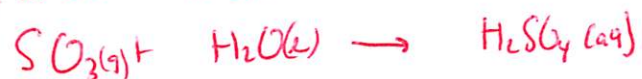
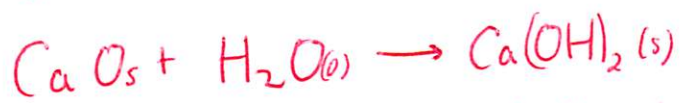
react w/ Oxygen - form oxide



w/ 2 nonmetals



Syn ~~ad~~ w/ oxides

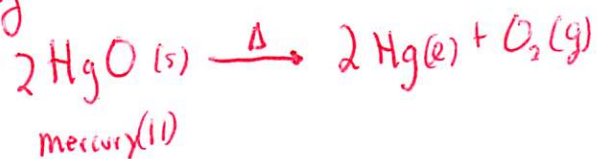


Decomposition Rxns

↳ 1 compound undergoes rxn to produce 2 or more simple subs



Decomp of binary



Electrolysis



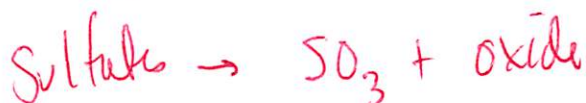
metal Hydroxides



metal chlorates

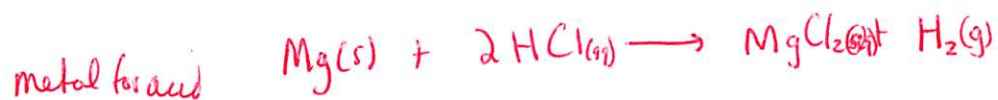
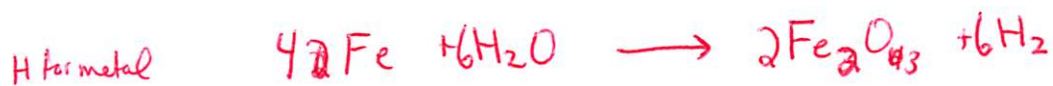


~~acid~~ Carbonates



Single replacement Rxns

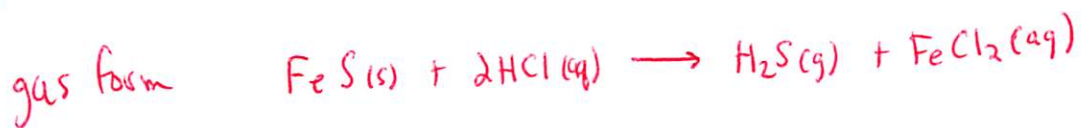
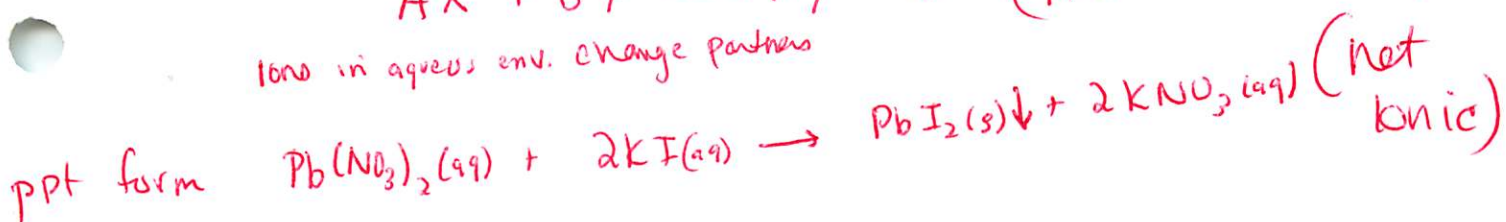
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Double Replacement (ionic rxns)



ions in aqueous env. change partners



Combustion - sub combines w/ O_2 to ~~form~~ release E

Hydrocarbons (compounds w/ C + H) result in $CO_2 + H_2O$

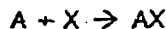


TABLE 8-3
ACTIVITY SERIES OF
THE ELEMENTS

Activity of Metals	
Li	
Rb	
K	Can react with cold
Ba	H ₂ O and acids,
Sr	replacing hydrogen.
Ca	
Na	
Mg	
Al	Can react with
Mn	steam and acids,
Zn	replacing hydrogen.
Cr	
Fe	
Cd	
Co	Can react with
Ni	acids, replacing
Sn	hydrogen.
Pb	
H ₂	
Sb	React with oxygen,
Bi	forming oxides.
Cu	
Hg	
Ag	Fairly unreactive.
Pt	Form oxides only
Au	indirectly.
Activity of Halogen Nonmetals	
	F ₂
	Cl ₂
	Br ₂
	I ₂

TYPES OF CHEMICAL REACTIONS

SYNTHESIS

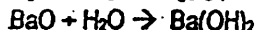
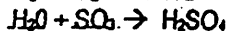
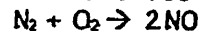
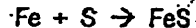


Metal + nonmetal

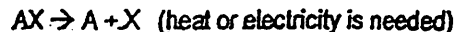
Nonmetal + nonmetal

H₂O + nonmetal oxide \rightarrow acid

H₂O + metal oxide \rightarrow base



DECOMPOSITION



Subcategories:

Binary (two element) compounds \rightarrow element + element

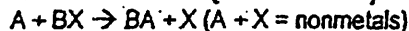
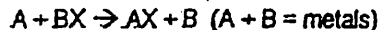
Ternary (3 element) acids \rightarrow nonmetal oxide and water

Metallic carbonate \rightarrow metallic oxide and carbon dioxide

Metallic hydroxide \rightarrow metallic oxide and water

Metallic chlorates \rightarrow metallic chlorides and oxygen

SINGLE REPLACEMENT



These reactions normally occur in aqueous solutions of the BX compound. A reaction will only occur if A is more reactive than the element it would replace.

Subcategories:

Active metal replaces less active metal

Active halogen replaces less active halogen

Very active metal replaces hydrogen in water (forming hydrogen gas + metal hydroxide)

Active metal replaces hydrogen in acids (forming hydrogen gas + a metal compound)

DOUBLE REPLACEMENT

(ionic reactions)



These reactions only occur in water solutions. Sometimes one of the predicted products decomposes into simpler substances. A reaction occurs only if one of the following occurs:

Water is a product

A precipitate forms (solubility table needed)

A gas forms (if one of the following is one of the products it decomposes further into the following products)

- for ammonium hydroxide – write instead ammonia and water
- for hydrogen carbonate – write instead carbon dioxide and water
- for hydrogen sulfite – write instead sulfur dioxide and water

COMBUSTION

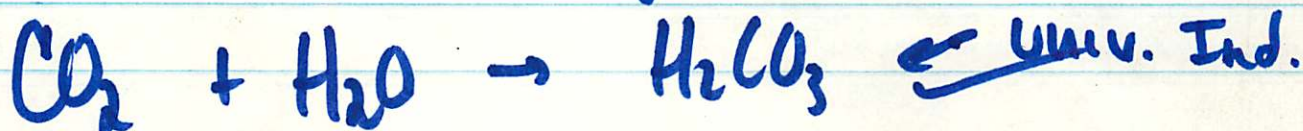
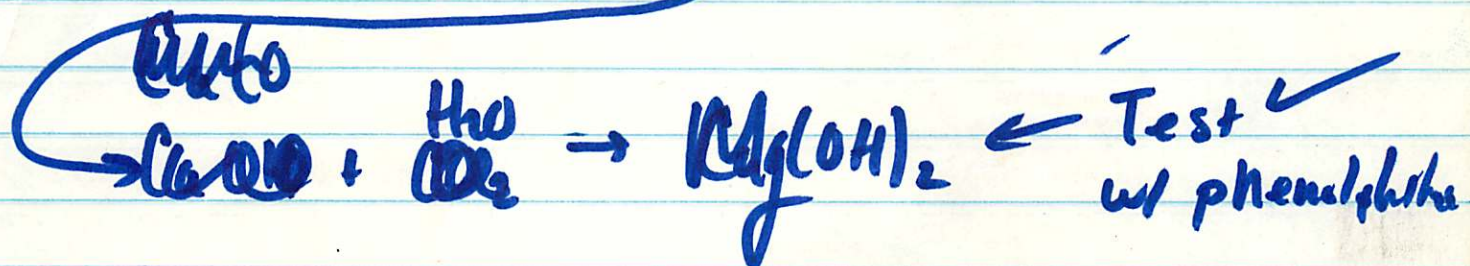
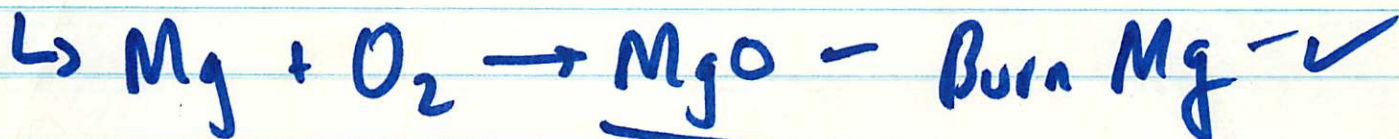
A fuel (CH compound) + oxygen \rightarrow carbon dioxide + water

(a fuel is a hydrocarbon compound with only carbon and hydrogen in its formula)

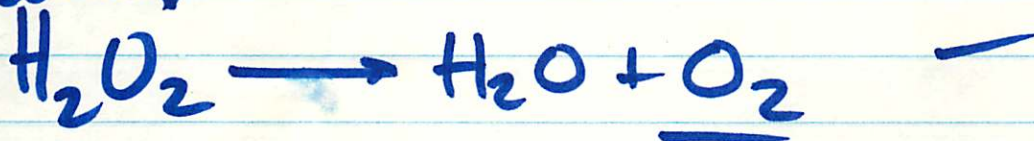
(incomplete combustion will yield carbon monoxide instead of carbon dioxide – because not enough oxygen was present)

Demo's

Sgn



Decomp



S. Rep

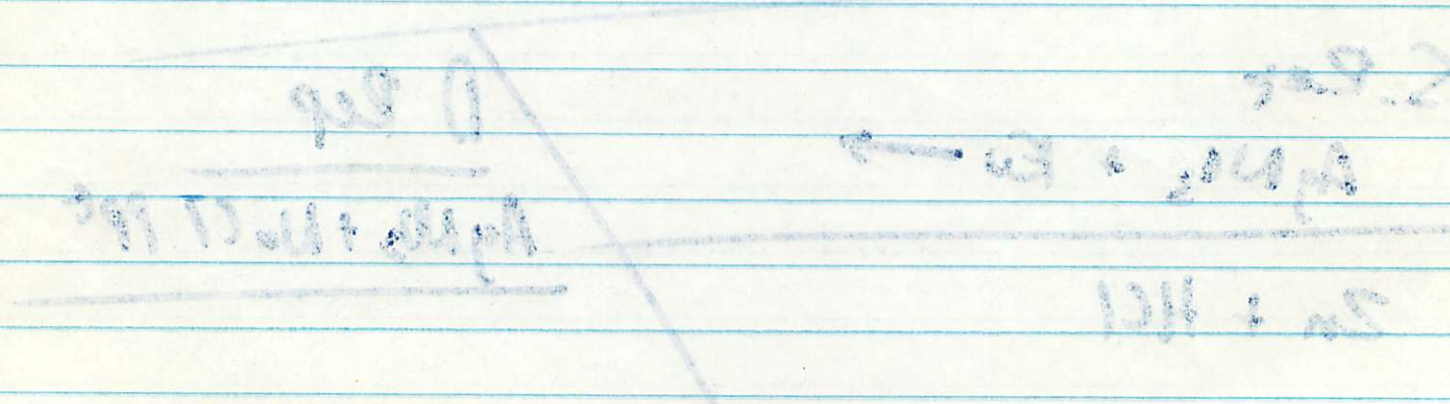
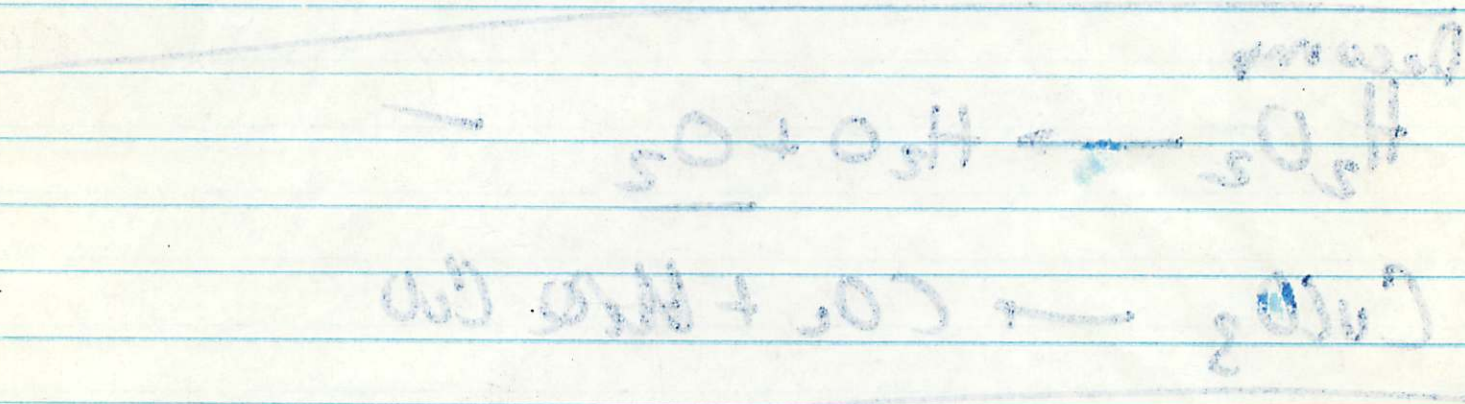
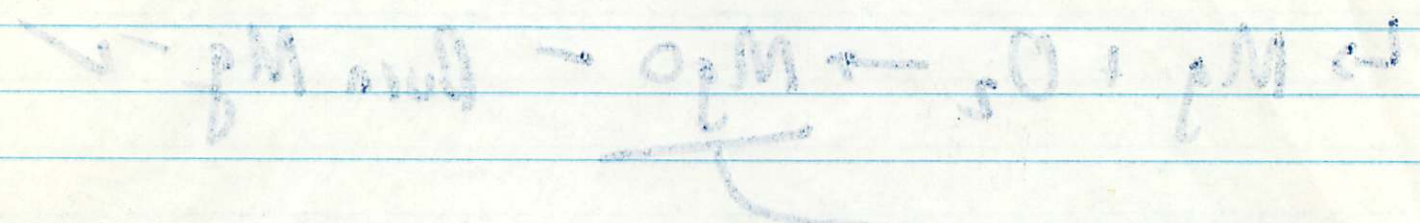


D Rep



2. amol

np2



8.3 Activity Series of Elements

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Activity - ability of an element to react

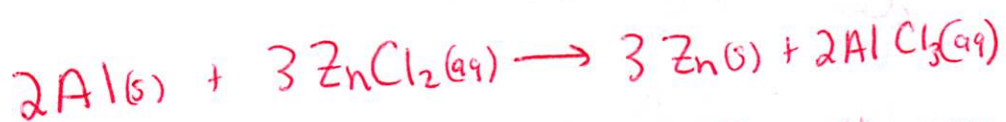
Activity series - list of elements based on their activity

Table 8-3 show overhead

Thus writing a chemical rxn does not mean it will take place. Must refer to the activity series

The higher the element is the more reactive it is
lower elements can't replace ones that are ~~lower~~ higher

We can now predict if a rxn will occur



Al higher than Zn will occur



Co lower than Na won't occur

H- Activity Series

- Oxides of metal below Cu decompose through heat only

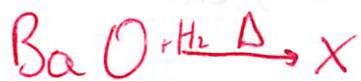


(b/c stable elements)

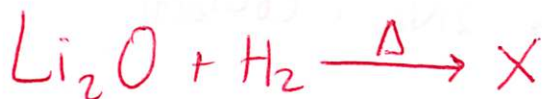
- Oxides \downarrow Cr \rightarrow metals when heated w H_2



- Oxides \uparrow Fe \nrightarrow metals when heated w H_2



b/c too reactive they are more stable



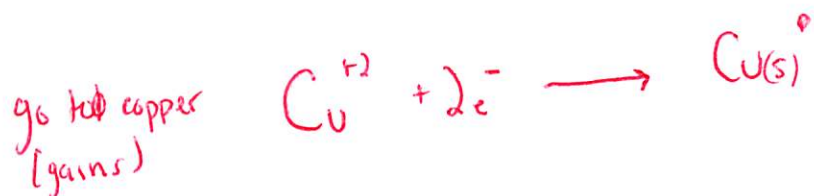
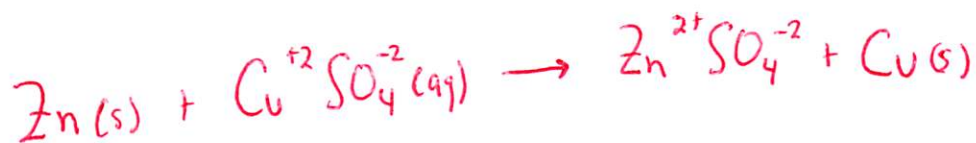
Theory behind Activity Series

(7)

↳ All based on experimental results

The farther apart 2 elements are more likely rxn will take place.

Rxns take place by e^- loss + gain



gain of e^- is reduction
loss of e^- is oxidation

end Ch 8

Use Solubility Table to
Determine if D. Rep take place.